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# IOT based Smart Campus

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***Abstract:*** **-- The word smart itself represents intelligence. The paper is based on the technological improvements to a campus using Internet of Things (IOT). Use of this technology is necessary to develop an institution. In this work, the four new methods of technology are explained. They are attendance monitoring system, automatic electricity consumption reduction system, campus monitoring system and floor cleaning. All these things are realized using IOT, PIR sensor, cloud storage, Arduino Mega Microcontroller.**

***Keywords*****: -- Internet of Things (IOT), Attendance monitoring, electricity consumption, floor cleaning, PIR sensor, cloud storage, Arduino Mega Microcontroller.**

## I. INTRODUCTION

The technology has been updating day-to-day, with which the human should also get updated. The development of technology plays an important role in Indian economy. Nowadays there are many educational institutions, which are maintaining good academics. In the present world selection of a right educational institution has become a crucial task for parents and also for management it is to improve the institution and it is very important in order to gain the attention of peoples towards getting admitted in their college. To drag the attention of the people towards the institution, first the institution should be improved, which is made possible with the help of smart campus technology. For example, in an educational institution it's been difficult to locate the chair persons in some important situations such as, conference and meeting. In such cases one can apply this smart campus concept. That is if a jacket with a sensor fixed in it, is provided to all the staff members of the institution. In the situation, whenever their presence is needed, quad-copter is sent in search of them. It detects the sensor signal and informs the person that the required chair person is in the particular locations and through IOT one can get updated where exactly the person is present, the technology can also be implemented to maintain cleanliness in the campus by using automatic cleaning machines, in this systems, the main control for all this task is done by using Arduino microcontroller. The floors of the corridor are cleaned with the cloth which is fixed to the tail end of the mobile robot. After cleaning of the floor, the acknowledgement is updated on to the cloud and the same is shared to the end user. Arduino microcontroller is preferred as it is open-source hardware platform with software IDE for writing program for the board. It is a tiny computer which could control many devices at a time and is having many communication interface features. The board is very low cost and offers cross-platform. The programming is easy and it supports lots of many features like I2C, SPI, CAN protocol, and it is more user friendly when compared to others that are available in the market.

The major hurdle for implementing is the cost of PIR sensor, drone, floor cleaning robot cost is comparatively high and also cost of maintenance is also high, initial cost of implementing is high. Therefore the decision has to be taken by the management for implementing it for better growth of the institution and to look unique from other institutions. Cost of sensors is more and a sensor hub is to be created which is a bit tedious process and updating the technology every year is a tedious process.


***Figure 1Arduino Mega Microcontroller***

In Smart campus, we have total four different features. First one is the Attendance monitoring system in which every student is given ID card Tags in which

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RFID Tag is attached and using RFID reader, total number of students inside the classroom can be counted and each individual student's attendance database is maintained by transmitting each data to server as shown in Fig 2. This method can also be implemented in order to mark the attendance of students and faculty members. Also, each time when any faculty or student enters or moves out of the classroom will be recorded and log-in/log-out sound will be made by using buzzer. Second one is the automatic electricity consumption reduction system that is implemented by installing PIR sensor in all classrooms which will automatically detects the human's presence inside the classroom and turns OFF lights and fans whenever necessary. If no students or faculties are present then controller will automatically turns off all lights and fans with the help of relay switches. Third one is the campus monitoring system by using Quadcopter/ drone, in which the drone is instructed to move on the campus, where the information is recorded and the same is conveyed to the end user/ to the heads of the institution. Fourth is, automatic cleaning of the corridors without any user intervention. Upon completion the completion time is updated onto the database, and the same is shared with the end user as shown in the Fig 2.

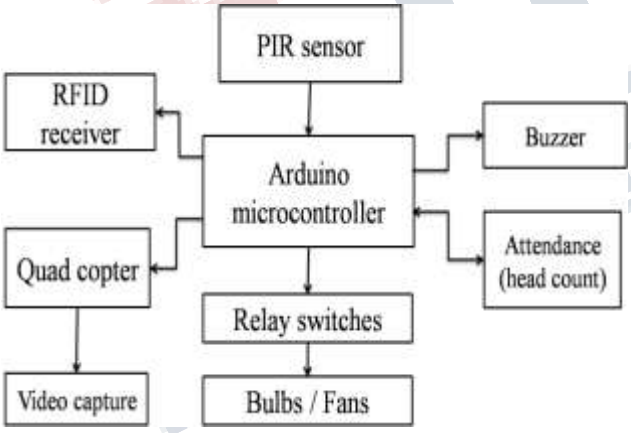


***Figure 2 Block diagram of smart campus***

LM293 is used to drive DC motors which are controlled by Arduino microcontroller, as motors need more current to drive. Arduino Microcontroller is not capable of supplying enough current drive capability. The cost of implementing is less when compared to conventional method of cleaning floors as shown in Fig 3

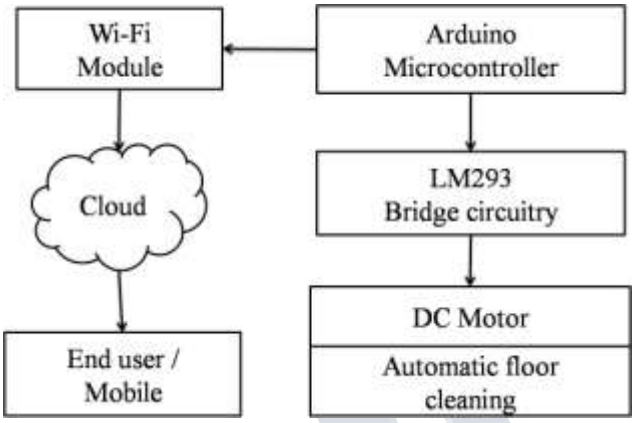


***Figure 3 Block diagram of smart campus***

## II. RELATED WORK

The applications of the smart school/ college are the combination of computation of cloud computing and smart school/ institution. We can combine isolated system such as finance management system, educational management system, library management system) office system by IOT technology. The application framework of smart campus is a mixture of IOT and cloud computing based on the internet and high performance computing [7]. The application of smart campus is composed of teaching, management, library management, logistics management, school realizes the card management including attendance access library card, control card etc [1] [5].

In smart campus, a teacher is not been made to take attendance of the students, instead the data of the students are taken from the RFID sensor which is mounted inside the students ID card. Thereby maintaining the student's attendance database seems to be very easy and conveniently accessed through a dedicated server [7].

Library management: one can have the new management mode in the library based on IOT concepts. Library takes the information and it feeds the data into the electronic tag. The user can access the resources required at anywhere through GPS technology [2]. These tags combine the library card, mobile phone and other physical objects. The new mode can realize the

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communication between user and library, user and resource [8] [9].

The technique describes to achieve a large sensing distance that makes suitable for installation across ground level reservoirs (GLR) and overhead tanks (OHT). The wireless network, which uses sub-GHz radios, connects to a gateway that can upload the data online for analytics and visualization. To design the preliminary results of an IoT based system for management of the water distribution system in a large campus. In particular, focus is on two specific components of the system: a sub-GHz based campus scale wireless network to connect the actuator and sensors and a very low cost ultrasonic based water level sensor is required. [9].

The paper explores some a novel approaches to harnessing the Internet-of-Things (IoT) as research vehicle and a teaching in education to empower depth knowledge in the minds of students[11].

## III. IMPLEMENTATION DESIGN

The Design and implementation of smart campus is made by making use of main controller Arduino Mega which acts as the main server. All the data will be updated to the Arduino Mega as main server.

### *3.1 PIR sensor*

Arduino microcontroller is interfaced with the PIR sensor, buzzer. The project is implemented as shown in the above block diagram. Hardware devices and peripheral devices are initialized and checked whether they are in working condition. To detect the location of a chair person say principal of a college the message is fed to Arduino board and it is transferred to the quad-copter. The quad-copter starts searching for that person all around and finds his location by capturing his video and reports the same to the Arduino board which is informed to the end user through IOT.

### *3.2 Flowchart*

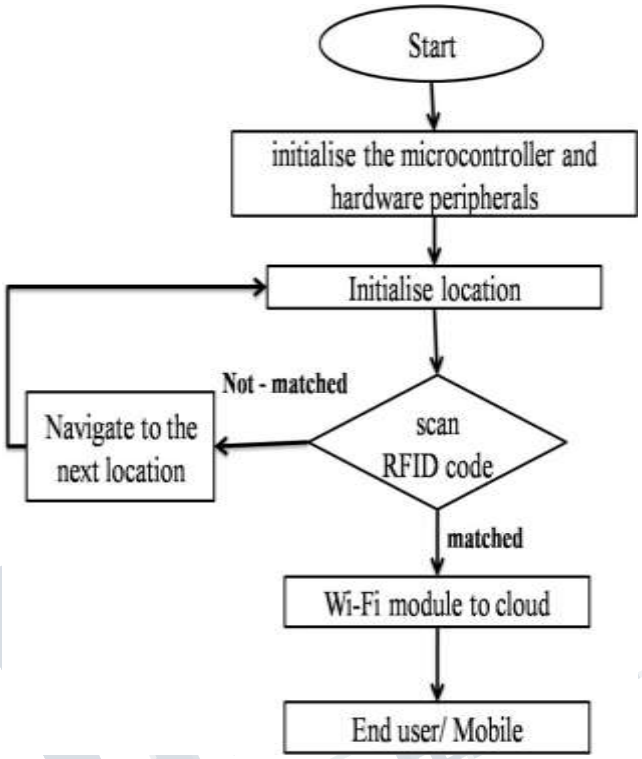


***Figure 4 Flowchart describing person identification using RFID tag***

Fig 4 explains the working of identification of a person within a campus. First initialize the location (0, 0, 0). Scan for RFID identification, if the person's RFID is not found, navigate to the next location, if found; update the location onto the cloud, the same data is shared with the end
User.

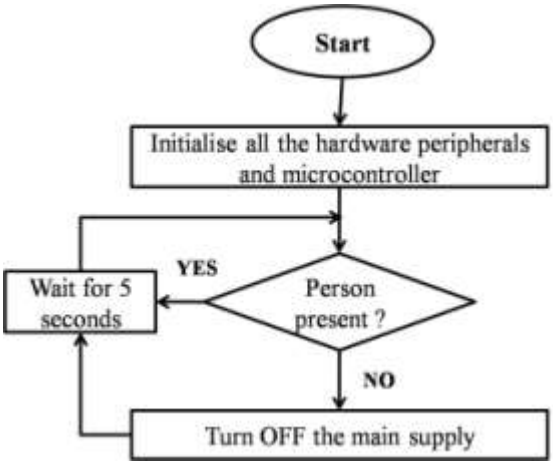


***Figure 5 PIR flowchart***

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Fig 5 describes how a person presence can be identified with the help of PIR sensor. First step is to check for hardware issues, if there is no issue, check for persons presence with the help of PIR sensor, if the PIR sensor reading determines person presence, main power state will be retained the previous state and the above condition is checked for intervals of 5 seconds. If no person is present in the room, the main control to the room is turned OFF with the help of relay switch, this saves enormous power. Fig 6 describes the visual monitoring of the campus in which the drone (Quadcopter) is given the command to go round the campus. While navigating, the camera placed in the drone is turned ON and is used to take the video of the activities that are happening in the campus. When the drone navigates and reaches the destination location, it is made to traverse back to the initial location. The captured video is shared on to the end user and the timings are updated onto the cloud. The stored results provide the localized information of the respective staff person.

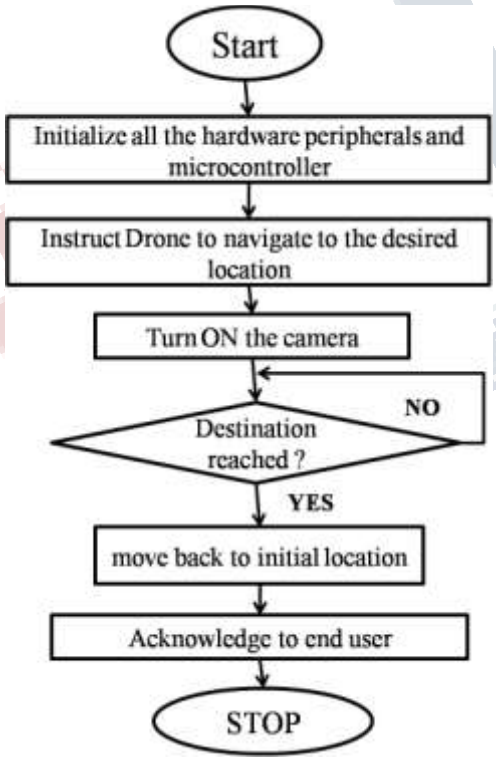


***Figure 6 Visual monitoring of the campus***

***3.3 Electricity abundance***

The power consumption is increasing when compared to than power production from the plant and regular power interruption due to shortage of power source. Hence, the electricity is abundant in nature. Hence, scaling in the devices parameters, leads to low power consumption. Thereby more sensors can be incorporated in portable devices. Thereby the functionality of the system can be increased.

***3.4 Cloud storage***

Cloud storage is an intermediate storage space between two ends of communication channel. The data is duplicated and is taken backup and stored in cloud; thereby one can avoid loss of failure of data when the system fails to perform its task correctly. As most of the persons are using smart mobile phone, their data can be taken back up into Dropbox or Google plus accounts, C M Security etc. The failure rate of cloud storage is comparatively very less when compared to secondary storage space and primary storage space. The maintenance cost of cloud servers is comparatively high. To achieve this the system should be compatible with 3G/ 4G, and this technology is highly preferred.

## IV. SIMULATION RESULTS

The sensor readings (PIR) are fetched from the Serial monitor of the Arduino microcontroller's result window. The data is recorded and the values are stored as .txt file, the values are graphically and are computed in Matlab tool.

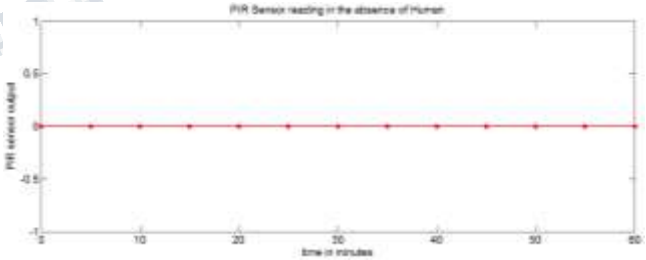

***Figure 7 absence of Human in the room***

The Fig 5 shows the absence of human in the room, the sensor readings are extracted over a period of 1 hour, and it has been shown that PIR sensor displayed null value i.e, there is no indications of any human beings..

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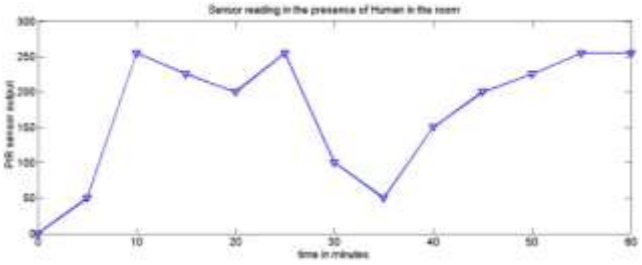


***Figure 8 Human movement inside the room***

The Fig 6 shows the presence of human inside the room, the sensor readings are extracted over a period of 1 hour, and it was been proved that PIR sensor displayed the corresponding human distance reading. The fluctuation in the graph shows the movement of person inside the room. The data is extracted from the Arduino microcontroller's serial monitor. The data samples are read every five seconds.

## V. CONCLUSION

It has been concluded that if the updating technology is implemented in the campuses of different institutions. Then managing the institution becomes easy and requirement of man power decreases which will lead to decrease in the annual expenses by the institutions. Hence, this technology is highly acceptable for the smooth running of the establishments.

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